5.16.01 SAMPLING AGGREGATES (Kansas Test Method KT-1)

a. SCOPE

These methods apply to the sampling of coarse and fine aggregates for quality tests and for inspection and testing of aggregates being produced for State construction and maintenance work. KT-1 reflects testing procedures found in AASHTO T 2 and T 248.

Where practicable, samples to be tested for quality shall be obtained from the finished product. Conditions may require sampling from hauling units or from stockpiles located at the production plant site or a specified location.

General policy regulations covering the frequency of and procedures for sampling aggregates are set forth in section **5.02** of this manual.

b. REFERENCED DOCUMENTS

b.1. KDOT Construction Manual; Part V; Section **5.02**

b.2. AASHTO T 2; Sampling of Aggregates

b.3. AASHTO T 248; Reducing Field Samples of Aggregate to Testing Size

c. SAMPLING METHODS

c.1. Sampling from Bins or Belt Discharge: Obtain at least three approximately equal increments, selected at random from the unit being sampled, and combine to form a field sample whose mass equals or exceeds the minimum. Take each increment from the entire cross section of the material as it is being discharged. It is usually necessary to have a special device constructed for a particular plant. This device consists of a pan of sufficient size to intercept the entire cross section of the discharge stream and hold the required quantity of material without overflowing. A set of rails may be necessary to support the pan as it is passed under the discharge stream. To the extent possible, keep bins continuously full to reduce segregation.

NOTE **a**: Sampling the initial discharge or the final few tons from a bin or conveyor belt increases the chance of obtaining segregated material and should be avoided.

c.2. Conveyor Belt: Obtain at least three approximately equal increments, selected at random, from the unit being sampled and combine to form a field sample whose mass equals or exceeds the minimum. Stop the conveyor belt while the sample increments are being obtained. Insert two templates, the shape of which conforms to the shape of the belt in the aggregate stream on the belt. Space the templates such that the material contained between will yield an increment of the

required mass. Carefully scoop all material between the templates into a suitable container and collect the fines from the belt with a brush and dust pan and add to the container.

c.3. Railroad Cars and Trucks: Sample coarse aggregate in railroad cars by digging three or more trenches across the car. Visual appearance will give a reasonable estimate for the characteristics of the load. The trenches must be approximately 1 ft (0.3 m) deep and 1 ft (0.3 m) wide at the bottom. Boards or other suitable objects are used to prevent the aggregate from rolling into the trench which would result in a biased sample. A minimum of three increments from approximately equally spaced points along each trench should be taken by pushing a shovel downward into the material.

Sample coarse aggregate from trucks in essentially the same manner as for rail cars, except for adjusting the number of increments according to the size of the truck.

Sample fine aggregate with a sampling tube having a diameter at least three times the size of the maximum size aggregate being sampled, or by use of a shovel. The outer layer, which may become segregated, should be removed and the sample taken from the material beneath. Take a minimum of five increments of material of approximately equal size from various points in the car or truck by inserting the tube or digging a hole with a shovel to a depth of not less than 1 ft (0.3 m).

c.3.a. Combine individual increments to form a field sample (whether coarse or fine), mix and reduce for testing.

c.4. Stockpiles: Where power equipment is not available, samples from stockpiles should be made up of at least three increments taken from the top third, an the mid-point, and at the bottom third of the volume of the pile, A board shoved vertically into the pile just above the sampling point aids in preventing further segregation. Scalp some of the aggregate to make sure you get a representative sample. Combine the individual increments to produce a field sample weighing not less than 75 lb (35 kg), mix thoroughly and reduce to the specified size for testing.

When possible, avoid sampling from stockpiles. It is very difficult to ensure unbiased samples due to the segregation which often occurs when material is stockpiled with coarse particles rolling to the outside base of the pile. For coarse or mixed coarse and fine aggregate, every effort should be made to enlist the services of power equipment to develop a separate, small sampling pile. Compose the sampling pile of material drawn from various levels and locations of the main pile after which several increments may be combined to obtain a field sample. The increment samples may be taken by hand methods following the procedure outlined in the above paragraph or they may be taken from the bucket of a front end loader. Do not use a front end loader if aggregates fail to flow freely from the bucket. If the aggregate is acceptable for front end loader sampling, three or more buckets of material taken from different locations in the pile should be sampled. Sampling from the bucket is accomplished by raising the bucket to approximately shoulder level. Tip the bucket to obtain a uniform flow of material and pass the sample container through the entire length of the material flow in the same manner previously described in **c.1.** of this test method. The three or more increments are then combined to make the field sample. If necessary, separate samples should be drawn from separate areas of the pile to demonstrate the degree of variability existing within the main pile.

Sample fine aggregate stockpiles with a sampling tube or shovel. Scalp away the outer layer of fine aggregate to reassure the sample has not become segregated. Obtain a minimum of five increments at several locations in the pile with equal number of samples taken from each 1/3 volume of the pile by inserting the tube or digging a hole 1 to 2 ft (0.3 to 0.6 m) deep. Combine the individual increments to form a field sample, mix and reduce to proper size for testing.

c.5. Plant Mixed Aggregate: There are several acceptable methods of taking samples from each type of plant. Every situation should be studied and evaluated to determine whether or not the method to be used will provide a representative sample of the material being produced. Plant mixed aggregate samples are generally obtained by one of the following procedures. If these procedures, due to unforeseen circumstances, prove to be unworkable, other procedures may be used if approved in writing by the District Materials Engineer.

c.5.a. Apparatus.

c.5.a.1. For Asphalt Plant Sampling.

c.5.a.1.a. For Batch Plants: A vertical receptacle having a closed bottom and an open top with no dimension in the opening of less than 5 in (125 mm). Appropriate handles for lifting and handling and a wide flat base for vertical stability are recommended. The height of the container must be sufficient that it will not overflow during the discharge of material from the pugmill.

Some containers have been designed to automatically split the material that enters the opening into two or more portions and discard one-half or more of all material received.

c.5.a.1.b. Continuous Flow Plants: A horizontal trough having a minimum width of 5 in (125 mm), a minimum depth of 12 in (300 mm), and a length equal to or greater than the width of the pugmill discharge stream, so constructed that it can be passed through the pugmill stream in a horizontal plane. Appropriate handles for lifting and handling are required. The apparatus shall meet the requirements in **c.1.**, Production or Loading Streams, and be approved by the District Materials Engineer.

c.5.a.2. For Screenless Operation Sampling: The apparatus shall meet the requirements in **c.1.**, Production or Loading Streams, and be approved by the District Materials Engineer.

c.5.b. Procedure.

c.5.b.1. For Asphalt Plant Sampling.

c.5.b.1.a. Batch Plants: Center the container under the pugmill discharge, open the gate and empty the pugmill before removing the container.

c.5.b.1.b. Continuous Flow Plants: Pass the container horizontally through the drum discharge stream in such a manner that a representative sample will be obtained, and the container will not be filled to overflowing.

c.5.b.2. For Screenless Operation Sampling: The contractor shall provide a system for sampling the combined material ahead of the mixing chamber. Such a system must be approved by the District Materials Engineer.

c.6. Windrows: Windrows are not to be sampled until all blending and mixing is completed. They must be sampled by methods that will insure that the sample will be representative of the material within the windrow cross section at the point of sampling. Power equipment is helpful in cutting through a windrow prior to sampling and should be used whenever available. Samples should be of ample size to be representative of the windrow at the point of sampling and reduced to proper size for testing.

It has been determined that windrows containing aggregate with not more than 10 percent of material retained on the 3/8 in (9.5 mm) sieve and not more than 25 percent crushed material may be effectively sampled with a standard sampling tube.

To provide an acceptable sample, the following conditions are required:

c.6.a. A properly mixed and well "peaked" windrow.

c.6.b. Force the tube into the windrow an equal number of times, well-spaced, on each side of the windrow, and in a direction normal to the slope of the windrow face.

c.6.c. Sample size sufficient for reduction by splitting using the standard procedure. Not less than a 75 lb (35 kg) sample is recommended.

c.7. Unopened Sand-gravel Deposits: Unopened deposits of sand-gravel are usually explored by drilling test holes spaced at regular intervals over the area underlaid by the deposit. The holes are extended through the soil and other non-usable over-burden and through the workable depth of the deposit. Remove the sand-gravel from each test hole and examine for major changes in quality and gradation characteristics, then record such changes. Place all usable material removed from each test hole on a quartering canvas, sheet of plywood, or other material to prevent contamination from grass, top soil, etc. Thoroughly mix a 15 lb (7 kg) sample for gradation tests.

If the quality of the material removed from all test holes appears to be reasonably uniform, a sufficient amount of material from each test hole should be obtained to produce a 200 lb (90 kg) composite sample for quality testing. This sample will be tested for information only.

d. SAMPLE REDUCTION

d.1. Quartering Canvas Procedure: Samples that weigh 75 lb (35 kg) or more may be reduced to one-half size by using a quartering canvas. The canvas is not to be used as the first step in the reduction of samples smaller than approximately 75 lb (35 kg).

d.1.a. Spread the canvas on a smooth level surface, dump the sample in a pile near the center and mix by alternately lifting each corner and rolling the aggregate toward the opposite corner. This should be performed in a vigorous manner.

d.1.b. Center the material on the canvas in a uniform pile. Flatten the pile to a uniform thickness and diameter by pressing down the apex with a straight-edge scoop, shovel, or trowel (depending on the size of sample). Press down so that each quarter sector of the resulting pile will contain the material originally in it. The diameter should be approximately four to eight times the thickness.

d.1.c. Insert a rod, shovel handle, or similar object under the canvas and under the center of the pile and lift both ends of the rod to divide the pile into two equal parts. Remove the stick leaving a fold of the blanket between the divided portions. Insert the rod under the canvas and under the center of the resulting two piles at right angles to the first division and again lift the rod to divide the sample into four equal parts.

d.1.d. Discard two opposite quarters, combine the two remaining quarters, mix and reduce to proper size with a riffle splitter or by quartering procedure.

When a quartering canvas is used, the Field Engineer and District Materials Engineer should be certain that proper procedures are being followed at all times.

d.2. Riffle Splitter Procedure: The initial sample size shall be at least four times the size of the required test portion.

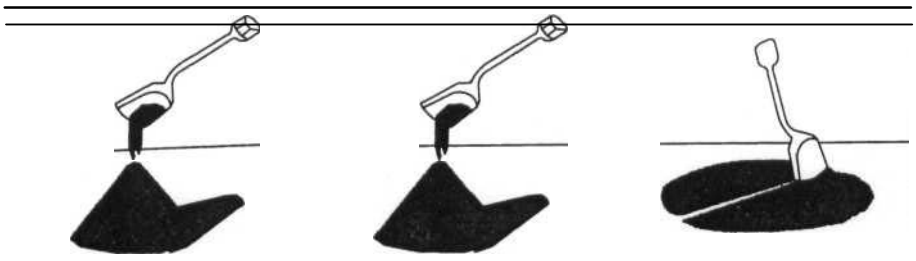
APPARATUS: The splitter shall have an even number of equal width chutes, but not less than a total of eight for coarse aggregate, or 12 for fine-aggregate, which discharge alternatively to each side of the splitter. For coarse and mixed aggregate the minimum width of the individual chutes shall be approximately 50 percent larger than the largest particles in the sample to be split. For dry fine aggregate in which the entire sample will pass the 3/8 in (9.5 mm) sieve, a splitter having chutes 1/2 to 3/4 in (12.5 to 20 mm) wide shall be used. The splitter shall be equipped with two receptacles to hold the two halves of the sample following splitting. It shall also be equipped with a hopper or straight-edged pan which has a width equal to or slightly less than the overall width of the assembly of chutes by which the sample may be fed at a controlled rate to the chutes. The splitter and accessory equipment shall be designed so the sample will flow smoothly without restriction or loss of material.

NOTE **b**: Any disputed samples shall be split using the appropriate splitter meeting the above specifications.

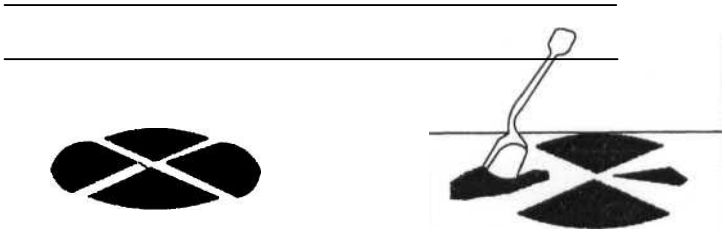
d.2.a. If use of this method is desired and the sample has free moisture on the particle surfaces, the entire sample may be dried to at least the surface-dry condition (SSD) using temperatures that do not exceed those specified for any tests contemplated. If the moist sample is very large, a preliminary split may be made using a mechanical splitter having a wide chute openings 1 ½ in. (38 mm) or more to reduce the sample to not less than 5000 g. Place the original sample in the pan and uniformly distribute it from edge to edge, so that when it is introduced into the chutes, approximately equal amounts will flow through each chute. Pans used with the splitter should fit the openings. The rate at which the sample is introduced shall be such as to allow free flowing through the chutes into the receptacles below. Retain all material until the entire sample has been through the splitter at least twice. Reintroduce the portion of the sample in one of the receptacles into the splitter as many times as necessary to reduce the sample to the size specified for the intended test.

d.3. Miniature Stockpile Sampling Procedure: This method of sample reduction may be used only on wet fine aggregate. For this quartering procedure, wet is defined as free moisture on the surface as approximated by the fine aggregate retaining its shape when molded by hand.

Place the sample on a clean, hard, level surface where there will be neither loss of material nor the accidental addition of foreign material. The initial sample size shall be at least four times the size of the required test portion. Mix the sample thoroughly with a shovel by turning it over completely three times. With the last turning, shovel the entire sample into a conical pile by depositing each shovelful on top of the preceding one. Carefully flatten the conical pile to a uniform thickness and diameter by pressing down on the apex with a shovel so that each quarter sector of the resulting pile will contain the material originally in it. The diameter should be approximately four to eight times the thickness. Divide the flattened pile into four equal quarters with a straight edge (trowel or similar metal blade) and remove two pre-selected diagonally opposite quarters, using a brush or broom to clean the cleared space. Repeat the process until the sample is reduced to the proper size.

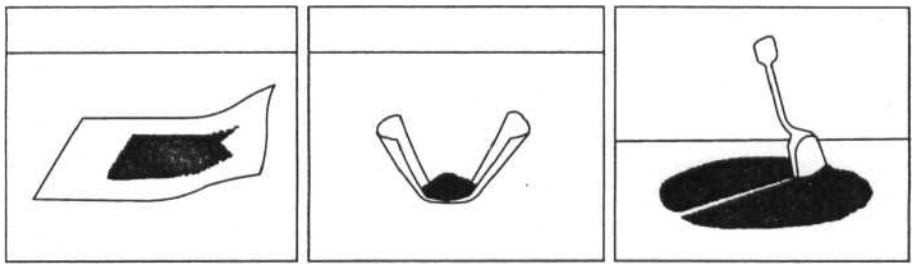


Cone Sample on Hard Clean Surface | Mix by Forming New Cone | Quarter after Flattening Cone



Sample divided into Quarters | Retain opposite Quarters Reject the other Two Quarters

Quartering on a Hard, Clean, Level Surface



Mix by Rolling on Blanket | Form Cone After Mixing | Quarter After Flattening Cone

Sample Divided into Quarters | Retain Opposite Quarters Reject the Other Two Quarters

Quartering on a Canvas Blanket